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BIBLIOGRAPHY OF IN-HOUSE AND CONTRACT REPORTS. SUPPLEMENT 6.(U)
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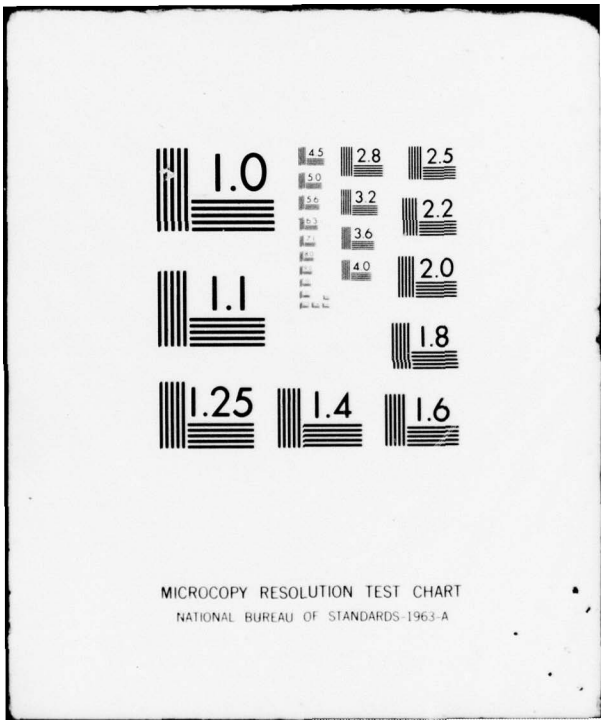
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Bibliography of in-house and contract reports, supplement 6

Sharon Murphy Odle

APRIL 1978

U.S. ARMY CORPS OF ENGINEERS
ENGINEER TOPOGRAPHIC LABORATORIES
FORT BELVOIR, VIRGINIA 22060

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(6) 4. TITLE (and Subtitle): BIBLIOGRAPHY OF IN-HOUSE AND CONTRACT REPORTS, SUPPLEMENT 6.

5. TYPE OF REPORT & PERIOD COVERED: Bibliography, Supplement 6, 1 Jan. 77 - 31 Dec. 77

6. PERFORMING ORG. REPORT NUMBER

(10) 7. AUTHOR(s): Sharon Murphy/Odle

8. CONTRACT OR GRANT NUMBER(s): (9) Rept. for 1 Jan - 31 Dec 77,

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
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Fort Belvoir, Virginia 22060

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS:
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13. NUMBER OF PAGES: 82 (12) 86p.

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This is supplement 6 to the report titled "Bibliography of In-House and Contract Reports," (AD-877 653L), (Supplement 1, AD-890 066L), (Supplement 2, AD-905 548L), (Supplement 3, AD-B005 275L), (Supplement 4, AD-B010 642L), (Supplement 5, AD-B019 966L). It is a continuing bibliography of reports prepared by and for the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Virginia. This bibliography includes reports published from 1 January 1977 through 31 December 1977.

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PREFACE

This is Supplement 6 to the report titled "Bibliography of In-House and Contract Reports" (AD-877 653L), (Supplement 1, AD-890 066L), (Supplement 2, AD-905 548L), (Supplement 3, AD-B005 275L), (Supplement 4, AD-B010 642L), (Supplement 5, AD-B019 966L). It is a continuing bibliography of reports prepared by and for the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Virginia. This bibliography includes reports that were published from 1 January 1977 through 31 December 1977.

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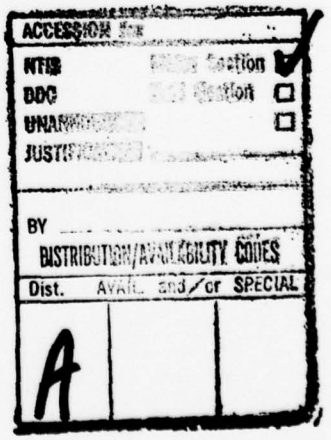

CONTENTS

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0063	2. GOVT ACCESSION NO. AD-A051 532	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Microreduction and Enlargement of Graphic Information Study (MEGIS)		5. TYPE OF REPORT & PERIOD COVERED Final Technical Report March 1975 to December 1977 6. PERFORMING ORG. REPORT NUMBER HESD/EOD-1624-F
7. AUTHOR(s) R. G. Zech, L. M. Ralston, B. R. Reddersen, and H. N. Roberts		8. CONTRACT OR GRANT NUMBER(s) DAAG53-75-C-0155
9. PERFORMING ORGANIZATION NAME AND ADDRESS Electronic Systems Division Harris Corporation Melbourne, Florida 32901		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE December 1977 13. NUMBER OF PAGES 397
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)* Microstorage and Retrieval, Holography, Cartography, Recording Media, Laser Recording, Micrographics, Archival Storage		

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The microreduction and enlargement of high-resolution graphic data such as map separations was investigated. Orginal graphics were photoreduced to 70mm film transparencies and stored as 20 X 20mm phase-randomized Fourier-transform holograms. Experimental data show that enlargement to full size produces only minimal distortion. Image brightness and brightness uniformity were adequate for reproduction. However, resolution and line quality did not meet current standards for cartographic production. Holography is judged to be a promising approach to high-density microstorage only if several fundamental problems can be solved.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0068	2. GOVT ACCESSION NO. AD-A035 481	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) PHOTO ANALYSIS OF A DESERT AREA		5. TYPE OF REPORT & PERIOD COVERED Technical Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Judy Ehlen		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U. S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52D
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE April 1976
		13. NUMBER OF PAGES 73
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Photo Interpretation Geology Geomorphology Arid Environment		

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Information derived from 1:9,600 scale stereoscopic aerial photography of a desert area near Yuma, Arizona, is presented. Physiography, geology, climate, landform, drainage, erosional aspects, vegetation, and cultural features are considered in the context of local and regional environmental, engineering, and military considerations. The second part of this report presents a field verification of the general geology, geomorphology, and vegetation in the study area with a list of selected references.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0081	2. GOVT ACCESSION NO. AD-A035 139	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) CAPABILITIES OF REMOTE SENSORS TO DETERMINE ENVIRONMENTAL INFORMATION FOR COMBAT		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Jack N. Rinker, Judy Ehlen, Alan E. Krusinger, Thomas R. Currin, Ambrose O. Poulin, Paul B. McCracken		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Research Institute, Center for Remote Sensing Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52C
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE November 1976 13. NUMBER OF PAGES 242
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Remote Sensing Environmental Information Combat Operations Climate and Weather Surface Configuration Vegetation Hydrology Surface Materials Geology Transportation Telecommunications and Electric Power Built-up Areas Agriculture (Continued)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) U.S. Army Field and Technical Manuals were used to develop a list of 313 environmental information needs, or factors, required by the Army to accomplish its various tasks. Each factor was evaluated against a list of remote sensing systems to determine the extent to which each system could provide the needed information. Interpretation procedures were restricted to evaluation of imagery by conventional interpretation techniques and equipment. The systems evaluated are LANDSAT (ERTS), radar, thermal (Continued)		

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19. (Continued)

Hydraulic Structures
Pollution
Map and Chart Revision
Construction
Site Selection
Construction Resources
Military Aspects

20. (Continued)

infrared, low-level oblique photography, standard photo index sheets, stereo 1:100,000 scale vertical aerial photography, and stereo 1:20,000 scale vertical aerial photography. Each image form is considered for each factor by a means of identification, i.e. by direct observation of the image, by measurements on the image, or by inferential procedures. For each category, one of four levels of capability is assigned. The levels are (1) a practical way of gaining information about a given factor, (2) a possible method, but with limitations, (3) the evidence is not available to make a judgment, but there is no reason that it cannot be done, and (4) the technique is not applicable to the specified factor. The factors were also evaluated in terms of the level of skill required to obtain the information. The evaluation includes comments and discussion about definitions of factors, difficulty in extracting needs from the manuals, limitations with reference to both the factors and procedures, and possible use of other sensor systems. Four examples that demonstrate the application of the evaluations to specific problems are presented following the evaluation: Cover and Concealment, Cross-Country Movement, Lines of Communication, and River Crossing Operations.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0083	2. GOVT ACCESSION NO. AD-A035 154	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* HOLOGRAPHIC TERRAIN DISPLAYS		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Michael M. McDonnell		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Project: 4A161102B52C Task: 03 Work Unit: 1452C030019
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE October 1976 13. NUMBER OF PAGES 46
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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Holography, terrain displays, holographic stereomodel, photointerpreter aids.

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The suitability of holography as a method for recording and reproducing visual displays of terrain is examined in a tutorial, non-mathematical manner. The paper is based chiefly on a literature search combined with some original work by the author. A brief introduction to the terminology of holography is followed by an exposition of a scheme of classifying hologram types which is used in the rest of the paper. Consideration of requirements for 3-D displays in general and the particular problem of making holograms of terrain is followed by a detailed discussion of the different types of hologram and how they may

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20. continued

be used to make terrain displays with different characteristics. Emphasis is on the 2-photograph stereoscopic hologram which is called a "holographic stereomodel". Techniques to enhance certain characteristics of holographic displays such as color rendition and efficient use of illumination are examined and possible uses of holography in tasks related to map making are suggested.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0084	2. GOVT ACCESSION NO. AD-A035 098	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Point Light Source Contact Printer Photographic Technology Series		5. TYPE OF REPORT & PERIOD COVERED Equipment Test Report 6. PERFORMING ORG. REPORT NUMBER NA
7. AUTHOR*(s)* Gunther Schwarz		8. CONTRACT OR GRANT NUMBER*(s)* NA
9. PERFORMING ORGANIZATION NAME AND ADDRESS Geographic Information Systems Division U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A762707A855 T3 02
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		12. REPORT DATE September 1976 13. NUMBER OF PAGES 11
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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Photographic Printer
Contact Printer
Point Light Source
Darkroom
Precision Printer

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes the point light source contact printer built in-house and the exposure characteristics of the light source. Tests performed in the printer were to determine uniformity and repeatability of the exposure.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0088	2. GOVT ACCESSION NO. AD-A035 457	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MATERIALS RESEARCH FOR HOLOGRAPHIC RECORDING (Report No. 1, Multiple Image Storage of Continuous Tone Data in Volume Holograms)		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER N/A
7. AUTHOR(s) John W. Eastes		8. CONTRACT OR GRANT NUMBER(s) N/A
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52C
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Holography
Storage and Retrieval of Continuous Tone Imagery
Angular Encoding of Multiple Holographic Images

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes tests and evaluation of 649-F plates for recording and storing multiple encoded continuous tone images for optical memories and display devices. Using this plate, up to 9 separate continuous tone images have been superimposed in a single location. Applications to graphical data storage and retrieval devices are discussed.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE 10 UNCLASSIFIED

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0089	2. GOVT ACCESSION NO. AD-A036 071	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) CHARGING EQUIPMENT, MOBILE (CEM)		5. TYPE OF REPORT & PERIOD COVERED Final Report Oct 72 – Nov 74
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Richard Basehore Steve Nagy		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Proj. No.: 1J664716D578 Task No.: 12 Work Unit: 0001
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE June 1976
		13. NUMBER OF PAGES 28
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report covers the design, fabrication, test, and operation of the Charging Equipment, Mobile (CEM) which provides a mobile battery charging capability to field units. The design and fabrication was performed in-house at the U.S. Army Engineer Topographic Laboratories to support the Long Range Position-Determining System (LRPDS). The CEM has been used specifically to recharge BB-451/U, silver-zinc batteries used with LRPDS backpackable ground

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20. continued

units. However, the dialable voltage cutoff in the battery charger will permit recharge of silver-cadmium and lead-acid batteries, among others. The equipment was used extensively in the field tests of the LRPDS for charging BB-451/U batteries at 2.25 amperes with a cutoff at 32 volts. Although activation of the BB-451/U batteries is a slow and painstaking operation, nine batteries were easily and reliably recharged at one time. Besides the operational tests, a safety evaluation and a road test were made by the U.S. Army Test and Evaluation Command. No unusual hazards were found, and there was no evidence of physical damage after runs over the Munson Road at the Aberdeen Proving Ground.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0090	2. GOVT ACCESSION NO. AD-A035 155	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* DIGITAL CARTOGRAPHIC STUDY AND BENCHMARK FIRST INTERIM TECHNICAL REPORT		5. TYPE OF REPORT & PERIOD COVERED Contract 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) D.J. Panton M.E. Murphy		8. CONTRACT OR GRANT NUMBER(s) DAAG53-75-C-0195
9. PERFORMING ORGANIZATION NAME AND ADDRESS Control Data Corporation 2800 East Old Shakopee Road Minneapolis, Minnesota 55440		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The key problem in the automatic generation of digital terrain data is the matching of conjugate points on a stereo pair of aerial photographs in an accurate and timely manner. The work described in this report centers around the development of suitable algorithms and systems procedures to perform this matching task in an all-digital environment.

Two approaches to automatic image matching have been investigated; a strip

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20. continued

processing approach and a block processing approach. Of the two approaches, it has been found that the block processing approach is more adaptable to the requirements of digital terrain data collection. Therefore, this approach is being investigated further for implementation in an array of fast, micro-programmable processors to provide a benchmark of matching system parameters and performance.

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4. TITLE *(and Subtitle)* DIGITAL CARTOGRAPHIC STUDY AND BENCHMARK SECOND INTERIM TECHNICAL REPORT		5. TYPE OF REPORT & PERIOD COVERED Contract 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) D.J. Panton M.E. Murphy		8. CONTRACT OR GRANT NUMBER(s) DAAG53-75-C-0195
9. PERFORMING ORGANIZATION NAME AND ADDRESS Control Data Corporation 2800 East Old Shakopee Road Minneapolis, Minnesota 55440		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia		12. REPORT DATE December 1975 13. NUMBER OF PAGES 28
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Stereo Image Matching	Microprocessors
Altorithm Distribution	Match Point Reliability
Block Matching Algorithm	Correlation Patch Shaping
Microprogrammable Processors	Flexible Processor(FP) Array

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes the practicality of implementing the automatic process of stereo image matching on a configuration of extremely fast micro-programmable processors. The report includes a three-phase program designed to bridge the gap between mathematical algorithm development and an actual hardware benchmark realization. The report concludes with the block matching algorithm being logically reconstructed and ready for microprogramming.

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4. TITLE (and Subtitle) DIGITAL CARTOGRAPHIC STUDY AND BENCHMARK 3RD INTERIM TECHNICAL REPORT		5. TYPE OF REPORT & PERIOD COVERED Contract 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) D. J. Panton M. E. Murphy		8. CONTRACT OR GRANT NUMBER(s) DAAG53-75-C-0195
9. PERFORMING ORGANIZATION NAME AND ADDRESS Control Data Corporation 2800 East Old Shakopee Road Minneapolis, Minnesota 55440		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia		12. REPORT DATE September 1976 13. NUMBER OF PAGES 38
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Benchmark algorithm
Correlation patch
Parallel Arrays

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the work and findings of Phase C, which is to implement and test on fast, microprogrammable processors, the stereo matching algorithm that was designed and analyzed under Phases A and B. This implementation was performed in terms of a benchmark to shed some light on the practicality of such a concept and to uncover the advantages and disadvantages of this particular kind of parallel processing application. The results stem from actually performing the benchmark rather than from a paper study outlining the approach to be taken. The benchmark was evaluated both in terms of its speed

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and accuracy. It was found that it takes about 11 hours of CDC 6600 processing to complete the correlation and matching of a typical 9 X 9 inch frame stereo overlap area, while the benchmark implementation can process the same area in a little over one half hour.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0093	2. GOVT ACCESSION NO. AD-A043 156	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* DIGITAL CARTOGRAPHIC STUDY AND BENCHMARK, FOURTH INTERIM TECHNICAL REPORT		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) D.J. Panton		8. CONTRACT OR GRANT NUMBER(s) DAAG53-75-C-0195
9. PERFORMING ORGANIZATION NAME AND ADDRESS Control Data Corporation 2800 East Old Shakopee Road Minneapolis, Minnesota 55420		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE July 1977 13. NUMBER OF PAGES 70
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*
Stereo Matching
Algorithm
Pixel

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*
This report is the fourth in a series of Interim Technical Reports that cover the development and implementation of a stereo matching algorithm that can be used in automatic terrain data collection. In particular, the results of Phase D of the contract are contained herein. The primary purpose of this Phase was to generalize the algorithm that was developed under Phases A, B, and C to handle more uncontrolled cases of central perspective photography and to

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE 18

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20. continued

lay the groundwork for handling non-central perspective photography. Previous developments and algorithm logic modifications have been reported in a rather piecemeal fashion over the first three Phases. This report combines all these developments into a consistent description of the matching algorithm as it appears to date, including the modifications of Phase D.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0094	2. GOVT ACCESSION NO. AD-A040 619	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* THE USE OF ARRAY ALGEBRA IN TERRAIN MODELING PROCEDURES		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) CPT Ronald L. Magee		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Automated Cartography Branch, Mapping Developments Division, Topographic Developments Laboratory USAETL, Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS R3205-01-04
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia -2060		12. REPORT DATE October 1976 13. NUMBER OF PAGES 45
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Array Algebra
Automated Cartography
Digital Cartographic Data
Terrain Modeling

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Array algebra, a new technique that finds the least-squares fit of a model equation to a set of ordered data, is investigated as a possible replacement for the current conventional least-squares polynomial-fitting technique. Both techniques are described and analyzed within the context of their applicability to current terrain modeling procedures and are compared for computational efficiency. This analysis specifically considers increasing the number of model polynomial terms (up to 256 terms) and discusses the impact of array algebra upon future R&D activities involving these high order polynomials.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0095	2. GOVT ACCESSION NO. AD-A038 497	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) PHOTOGRAMMETRIC ASPECTS OF THE HETERODYNE OPTICAL CORRELATOR		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Edward M. Mikhail		8. CONTRACT OR GRANT NUMBER(s) DAAG29-76-D-0100
9. PERFORMING ORGANIZATION NAME AND ADDRESS Purdue University Lafayette, Indiana 47907		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE July 1976 13. NUMBER OF PAGES 41
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Coherent Optics
Optical Spatial Correlation
Photometric Data Extraction

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Heterodyne optical correlation as applied to coherently illuminated overlapping transparencies is briefly discussed. Photogrammetric aspects of optical image coincidence are carefully studied for vertical as well as tilted photography. An experimental Heterodyne Optical Correlator (HOC) is described. A two-dimensional photo diode detector array is used in the output plane as a precise measuring system. It is shown that for regular aerial photography, it is not possible to place the transparencies untilted in the correlator and

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20. continued

expect tolerable y-parallaxes. Therefore, either the transparencies must be tilted, or the HOC should operate essentially as a comparator, with correlation taking place in the image space. For the latter case, one transparency is fixed and the other is moved in steps in both the x- and y-directions. The result is that for each array element one gets x, y coordinates on one transparency and p_x, p_y parallaxes from the other.

The results of two preliminary tests using aerial photography are given. They indicate accuracies of about one to two parallax steps (one step = 25 μm in the tests). However, the tests are so limited that the results should be considered only as preliminary, indicating the feasibility of the system as an area correlator. Further development and more extensive testing are recommended before the potential and accuracy of the HOC system may be determined.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0096	2. GOVT ACCESSION NO. AD-A038 463	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Development of Finite Element Models for the Earth's Gravity Field Phase I: Macro Gravity Model for Satellite Orbit Integration		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER UVA/525023/ESS77/103
7. AUTHOR(s) John L. Junkins		8. CONTRACT OR GRANT NUMBER(s) DAAG53-76-C-0067
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Laboratories for the Engineering Science University of Virginia Charlottesville, Virginia 22901		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineer Topographic Laboratories Ft. Belvoir, Virginia 22060		12. REPORT DATE February 1977 13. NUMBER OF PAGES 27
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) gravity, orbit integration, inertial navigation, finite element, approximation		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) As alternatives to lengthy globally valid series representations of the geopotential, piecewise modeling for the gravity field is investigated. A degree 23 spherical harmonic representation is replaced by 1500 local gravity functions within the spherical shell from 1 to 1.2 earth radii. Worst case acceleration errors enter in the 7th significant digit, computational speed is improved by an order of magnitude.		

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1. REPORT NUMBER ETL-0097	2. GOVT ACCESSION NO. AD-A038 468	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Development of Finite Element Models for the Earth's Gravity Field Phase II: Fine Structure Disturbance Gravity Representations		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER UVA/525023/ESS77/104
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s) DAAG53-76-C-0067
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Laboratories for the Engineering Sciences University of Virginia Charlottesville, Virginia 22901		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

gravity, orbit integration, inertial navigation, finite element, approximation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report develops locally valid Chebyshev polynomial representations of gravitational disturbance accelerations to use, for example, in inertial guidance calculations. The gravity field can be accurately represented in this fashion, the computational speed is increased by about a factor of twenty in comparison to point mass representations.

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1. REPORT NUMBER ETL - 0098	2. GOVT ACCESSION NO AD-A051 501	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Radar Image Simulation Project		5. TYPE OF REPORT & PERIOD COVERED Contract Report Dec. 1974 - May 1976
		6. PERFORMING ORG. REPORT NUMBER RSL Technical Report 234-15
7. AUTHOR(s) J. C. Holtzman V. H. Kaupp J. L. Abbott		8. CONTRACT OR GRANT NUMBER(s) DAAK02-73-C-0106
9. PERFORMING ORGANIZATION NAME AND ADDRESS University of Kansas Space Technology Center 2291 Irving Hill Drive Lawrence, Kansas 66045		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE September, 1976 13. NUMBER OF PAGES 29
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Radar, Image, Simulation, Digital, Optical, Interactive, Feature, Extraction, Airborne, Plan-Position, Indicator, Side-Looking, SLAR, PPI, Data, Base, Forward-Looking, Infra-Red, FLIR, Processing

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document summarizes the results of a radar image simulation study performed at the Remote Sensing Laboratory, the University of Kansas, Lawrence Kansas. The work was sponsored by the Engineering Topographic Laboratories, The United States Army, Fort Belvoir, Virginia. The goal of this study was to develop radar image simulation techniques. The purpose of this

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document is to summarize those investigations, to identify significant accomplishments, and to make recommendations concerning future research needs and potential applications of the results of this work.

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1. REPORT NUMBER ETL-0099	2. GOVT ACCESSION NO. AD-B018 942L	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* AUTOMATIC RESEAU MEASURING EQUIPMENT (ARME)		5. TYPE OF REPORT & PERIOD COVERED Equipment Test Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)* Maurits Roos		8. CONTRACT OR GRANT NUMBER*(s)*
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4302-01
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE August 1976 13. NUMBER OF PAGES 41
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report covers the engineering design tests and evaluation of the Automatic Reseau Measuring Equipment (ARME). The equipment was developed to provide a capability to measure automatically the coordinates of a large number of targets on photographs. The report concludes that (1) the ARME meets all essential requirements of the Technical Characteristics for which it could be tested, and (2) the ARME provides a rapid and accurate mensuration capability and is suitable for continued production use.

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1. REPORT NUMBER ETL-0100	2. GOVT ACCESSION NO. AD-A040 599	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* PLATFORM ORIENTATION SYSTEM TEST PROGRAM		5. TYPE OF REPORT & PERIOD COVERED Equipment Test Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Glenn W. Schmeidel		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 1S764716D578,29,0002
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE November 1976 13. NUMBER OF PAGES 24
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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)* Forward Observer Vehicle (FOV) Platform Orientation System (POS)-406 Flux-gate Compass		

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report discusses a limited field test performed on the POS (Platform Orientation System)-406. The function of the POS-406 is to provide a grid, true, or magnetic north reference to ground vehicles. The objective of this test program was to evaluate a magnetic type of north-seeker as the north reference in future FOV (Forward Observer Vehicle) development. Based upon the analysis of data obtained in this test, future FOV planning and development should include both magnetic and gyrocompass types of north references.

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1. REPORT NUMBER ETL-0101	2. GOVT ACCESSION NO. AD-B018 943L	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MULTISPECTRAL CAPABILITY OF H&W FILM (Photographic Technology Series)		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER NA
7. AUTHOR(s) Gunther Schwarz Avron Hecht (Appendix)		8. CONTRACT OR GRANT NUMBER(s) NA
9. PERFORMING ORGANIZATION NAME AND ADDRESS Geographic Information Systems Division U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A762707A855
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Photographic Technology
Film Testing
H&W Film
Photography
Photographic Film

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes tests that were conducted to determine the characteristics and possible multispectral applications of H&W film and developer. The report concludes that although the resolution is very high and granularity of H&W film is very low, the gamma of the film/developer combination is too low for multispectral photography. (The H&W Company markets the film and developer with the H&W label.)

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1. REPORT NUMBER ETL-0102	2. GOVT ACCESSION NO. AD-B018 952L	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) EVALUATION OF A NEW ELECTROSTATIC RECORDING MEDIUM		5. TYPE OF REPORT & PERIOD COVERED Research Note 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) JAMES W. GLADDEN		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52C, Task S2, Work Unit 1752CS20006
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Photoconductive Films
Electrostatic Recording Materials
Photosensitive Films
Sputtered Layers

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report evaluates the Type 101 KC-film and liquid developers obtained from Coulter Information Systems, Inc. for continuous-tone, line, and holographic recordings. The experimental work and data suggests the film and developers would be best suited for duplicating line photographic images, such as found in cartographic separations. Mechanization of the processing steps, namely corona charging, exposing, and developing is seen needed to enhance the resolution and contrast ratio of the image obtained. Resolutions

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in excess of 100 lines per mm and image densities on the order of 2.75 density units or greater may be obtained.

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1. REPORT NUMBER ETL-0103	2. GOVT ACCESSION NO. AD-A044 431	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* AN ANALYSIS OF LANDSAT SYSTEMS FOR CARTOGRAPHIC AND TERRAIN INFORMATION (Report No. 9 in the ETL Series on Remote Sensing)		5. TYPE OF REPORT & PERIOD COVERED Technical Report (Aug - Dec 76) 6. PERFORMING ORG. REPORT NUMBER NA
7. AUTHOR(s) Theodore C. Vogel		8. CONTRACT OR GRANT NUMBER(s) NA
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A762707A855 T3 0018
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE June 1977 13. NUMBER OF PAGES 58
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Remote Sensing
Aerial Imagery
Photo Interpretation
Multispectral Imagery
Cartography
Terrain Analysis
Thematic Mapping

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The scientific and technical literature is reviewed to analyze the capabilities of LANDSAT Systems 1, 2, 3, and 4 for hydrographic, topographic, planimetric, and thematic map compilation. The systems capabilities were analyzed according to the following qualitative code for a selected list of map and chart requirements: 0 - Not detectable, the map element cannot be discerned or located from either type of LANDSAT data; 1 - Detectable, map element can be detected but not identified from the type of LANDSAT data

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Item 20. (continued):

indicated; 2 - Identifiable, map element can be detected and recognized as a particular type of feature from the LANDSAT data indicated, e.g. road, canal, etc., collateral information may be required to reach this analysis level; 3 - Classifiable, LANDSAT data, with the use of all available collateral information, can provide the information required for the map element including all required measurements, e.g. width, length, and areas. It was concluded that LANDSAT 1, 2, 3 MSS data is compatible with National Map Accuracy Standards and can be used to update the map elements on map scales 1:1,000,000 through 1:250,000, although many of the cultural, hydrographic, and botanical elements may be unclassifiable. The improved systems capabilities of LANDSAT 4 may provide a method for updating map scales 1:1,000,000 through 1:50,000. However, many of the required cultural and hydrographic map elements may remain unclassifiable even with the Thematic Mapper system.

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4. TITLE *(and Subtitle)* BIBLIOGRAPHY OF IN-HOUSE AND CONTRACT REPORTS, SUPPLEMENT 5		5. TYPE OF REPORT & PERIOD COVERED Bibliography, Supplement 5 1 Jan 76 - 31 Dec 76 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) E. James Books		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE May 1977 13. NUMBER OF PAGES 104
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This is Supplement 5 to the report titled "Bibliography of In-House and Contract Reports." (AD-877 653L) (Supplement 1, AD-890 066L) (Supplement 2, AD-905 548L) (Supplement 3, AD-B005 275L) (Supplement 4, AD-B010 642L). It is a continuing bibliography of reports prepared by and for the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Virginia. This bibliography includes reports published from 1 January 1976 through 31 December 1976.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0105	2. GOVT ACCESSION NO. AD-A047 669	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* BACKSCATTERING OF RADAR WAVES BY VEGETATED TERRAIN		5. TYPE OF REPORT & PERIOD COVERED Technical Report May 1974 – October 1975 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)* Richard A. Hevenor		8. CONTRACT OR GRANT NUMBER*(s)*
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Geographic Sciences Laboratory Fort Belvoir, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52C
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		12. REPORT DATE June 1977 13. NUMBER OF PAGES 90
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Radar Scattering
Vegetation
Random Media
Renormalization Method

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report presents a vector theory for the backscattering of electromagnetic radar waves from vegetation. The basic technique employed in the solution required simulating the vegetation with a random medium. This medium possesses an electrical permittivity that is generated by a continuous random process and is characterized by a particular probability density function. A solution for the radar backscatter coefficient is obtained in terms of the statistical characteristics of the random medium. A comparison of the theory with experimental data is given.

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20. continued

Insight is given into the nature of depolarization, but explicit results for the depolarized terms are not obtained at this time because of the complexity and difficulty of the solution. Some of the conclusions of this work are

1. A theory has been developed for computing the like polarized (HH and VV) radar backscatter coefficients from certain types of vegetation by using a vector renormalization approach.

2. No rigorous quantitative comparison of theory with experiment was possible; however, qualitative comparisons indicate reasonable agreement.

3. Although no explicit solution was obtained for the depolarization components, it was learned that one cause of depolarization is the anisotropy associated with the correlation function of the dielectric fluctuations.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0106	2. GOVT ACCESSION NO. AD-B019 967L	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* XEROX 6500 COLOR COPIER		5. TYPE OF REPORT & PERIOD COVERED Equipment Test Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)* Guy N. Stockwell		8. CONTRACT OR GRANT NUMBER*(s)*
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories ETL-TD-EC Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 1G762707A576 Work Unit: 047 Task: 01
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE June 1977
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16. DISTRIBUTION STATEMENT *(of this Report)*

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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Reprography,
Xerography,
Color Reproduction,
Rapid Response

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report covers the engineer design tests performed with the Xerox 6500 Color Copier and applicable support items. The physical properties, operational characteristics, and related materials for reproducing multicolor map products on various printed mediums are being evaluated for quick economical reproduction in limited quantities of topographic and special map products. The tests showed that the color copier meets most of the technical requirements for Map Reporduction Equipment.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE 37

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL 0107	2. GOVT ACCESSION NO. AD-A041 038	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) DESIGN OF A MAP UPDATE CAPABILITY FOR ENGINEER TOPOGRAPHIC UNITS		5. TYPE OF REPORT & PERIOD COVERED Contract Report Final Technical Report
		6. PERFORMING ORG. REPORT NUMBER 53-0200-0001
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s) DAAG53-76-C-0176
9. PERFORMING ORGANIZATION NAME AND ADDRESS Raytheon Company 400 Army Navy Drive Arlington, Virginia 22202		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE May 1977
		13. NUMBER OF PAGES 70
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report contains the final conceptual design of two systems for the compilation of Field Army map updates using all types of tactical reconnaissance imagery as data input. Both systems are capable of producing Class B output accuracy, and incorporate innovative design features to improve ease of operation and system throughput. One system is designed to perform a monoscopic solution where the map is used as a source of control to form a terrain model that is combined with the appropriate sensor model to transform image
continued

20. continued

coordinates into their correct ground positions with relief displacement errors removed. The second system uses the mono solution for mono input imagery and a full analytical mapping solution for stereo input imagery. The systems' design evolution, theory of operations, technical characteristics, estimated costs, field deployed van layout, and cost effectiveness comparisons are presented.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0108	2. GOVT ACCESSION NO. AD-A041 039	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) DIGITAL TERRAIN DATA COMPACTION USING ARRAY ALGEBRA		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Urho Rauhala Stephen Gerig		8. CONTRACT OR GRANT NUMBER(s) DAAG53-76-C-0127
9. PERFORMING ORGANIZATION NAME AND ADDRESS DBA Systems, Inc. P.O. Drawer 550 Melbourne, Florida 32901		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE November 1976 13. NUMBER OF PAGES 55
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report investigates the applicability of array algebra digital terrain modeling and data compaction. Two options were evaluated for converting the collected data into regularly spaced terrain elevations. First, an array prediction is performed of the data directly in the epipolar coordinate frame. This approach allows for data compaction and subsequent evaluation at uniform intervals in a gridded map coordinate system. Second,		

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20. continued

the principle of array algebra in a piecewise translocation algorithm is applied. In this approach the non-gridded epipolar coordinates are first converted to regularly spaced elevation data and then subsequently compacted using the methods of array prediction. In addition to analyzing the mathematical equations required for terrain compaction, the computational requirements were analyzed for both sequential and parallel processors.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0109	2. GOVT ACCESSION NO. AD-A044 280	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Design and Feasibility Study of HOC as a Van Mounted Stereo Model Digitizer		5. TYPE OF REPORT & PERIOD COVERED Contract Report Final Report
		6. PERFORMING ORG. REPORT NUMBER EC/2106601-FR
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s) DAAK-70-77-C-0027
9. PERFORMING ORGANIZATION NAME AND ADDRESS EIKONIX Corporation 103 Terrace Hall Avenue Burlington, Ma. 01803		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE 12 July 1977
		13. NUMBER OF PAGES 64 (sixty-four)
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16. DISTRIBUTION STATEMENT (of this Report)

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Heterodyne optical correlation, Automated Stereo Compilation, Stereomodel digitizer.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report documents the results of the evaluation of the feasibility and applicability of a potential HOC system as a van mounted stereomodel digitizer. A HOC system model has been developed and it is evaluated by considering the tolerance specifications of the optical, mehcnaical and electronic subsystems as a function of their required performance characteristics. The results of this study indicate that a potential HOC system is highly competitive in its application as a van mounted stereomodel digitizer. Finally a conceptual design for a prototype HOC system has been presented and its potential advantages over other automated comilation systems have been outlined.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL - 0110	2. GOVT ACCESSION NO. AD-A043 869	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* BIMODAL DISPLAY		5. TYPE OF REPORT & PERIOD COVERED Research Note 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Jenny Bramley Edward G. Trelinskie, Jr.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161101A91D
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE June 1977 13. NUMBER OF PAGES 11
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes concepts, techniques, and results from experiments conducted using an experimental display device configured for display of map information and symbol presentations on a single viewing surface.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE 43

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0111	2. GOVT ACCESSION NO. AD-A044 401	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Cartographic Electron Beam Recorder (EBR) System		5. TYPE OF REPORT & PERIOD COVERED Final Contract Report 16 June 1975-18 July 1977 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) P.F. Grosso, A.A. Tarnowski		8. CONTRACT OR GRANT NUMBER(s) DAAG53-75-C-0221
9. PERFORMING ORGANIZATION NAME AND ADDRESS Image Graphics, Inc. 1525 Kings Highway Fairfield, Ct. 06430		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA. 22060		12. REPORT DATE 1 August 1977 13. NUMBER OF PAGES 73
14. MONITORING AGENCY NAME & ADDRESS(*if different from Controlling Office*)		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

1. Cartography
2. Electron Beam Recording
3. Character Generator
4. Vector Generator
5. Raster Scan Translator
6. Computer Controller & Software
7. Electron Optics
8. Automated Vacuum Systems
9. Recording Film
10. Random Access Beam Positioning

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes the development of an advanced model of a Cartographic EBR for use in plotting and recording a variety of map and image data on electron sensitive film. Performance levels achieved with the minicomputer controlled EBR are satisfactory for the automated production of a number of cartographic products. Recording spot sizes of 3 and 6 microns diameter; beam addressability of 32,000 x 32,000; image repeatability of 1/30,000; and

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19. continued

11. Input Magnetic Data Tapes
12. Digital Font Library
13. EBR Performance
14. Input Section
15. Central Processor Unit
16. Mass Storage
17. Data Translator
18. Recorder Unit
19. Film Transports
20. Computer Output Graphics
21. Micrographics

20. continued

geometric fidelity of 0.03% have been demonstrated. Image format sizes were 5" X 8", 4" X 6", 70 mm and 35 mm. 32 line widths can be varied automatically from 6 to 250 μm. Graphic arts quality characters can be recorded from 4 pts to 36 pts (at full scale).

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0112	2. GOVT ACCESSION NO. AD-A043 335	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* GRADIOMETER-AIDED RAPID GRAVITY SURVEY SYSTEM		5. TYPE OF REPORT & PERIOD COVERED Contract Report
		6. PERFORMING ORG. REPORT NUMBER SP-957-1-1
7. AUTHOR*(s)*		8. CONTRACT OR GRANT NUMBER*(s)* DAAG 53-76-M-5899
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Analytic Sciences Corporation Six Jacob Way Reading, Massachusetts 01867		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE April 1977
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Rapid Gravity Survey System (RGSS)
Gradiometry
Zero Velocity
Kalman Processing

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report considers a mobile vehicle equipped with both an inertial positioning system (IPS) and a gradiometer. For suitable gradiometer-aiding configurations, the following variables are determined: (1) Real-Time vs Post-Mission Data Processing, (2) Presence or absence of Terminal Calibration Data, (3) Continuous Time vs Halted Vehicle Gradiometer Operation, (4) Gradiometer Errors, (5) Zero Velocity and Gradiometer Calibration Stops, and (6) Gyro and accelerometer Errors. This report concluded that one sec or better gradiometer-aided

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20. continued

RGSS performance in open traverse is unlikely without vertical deflection end calibration. In addition, the keynote of successful RGSS/Gradiometer integration will be control and compensation of system bias and low frequency error sources.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0113	2. GOVT ACCESSION NO. AD-B020 810L	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* RAPID GRAVITY SURVEY SYSTEM AIDED WITH SUPPLEMENTAL GRAVIMETRIC DATA		5. TYPE OF REPORT & PERIOD COVERED Contract Report
		6. PERFORMING ORG. REPORT NUMBER SP-957-2
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s) DAAK70-77-17-0384
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Analytic Sciences Corporation Six Jacob Way Reading, Massachusetts 01867		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE April 1977
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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Rapid Gravity Survey System (RGSS)
Gradiometry
Kalman Filter
Zero Velocity

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report considers a mobile vehicle equipped with both an inertial positioning system (IPS) and a gradiometer. For suitable gradiometer-aiding configurations, the following variables are determined: (1) Real-Time vs Post-Mission Data Processing, (2) Presence or absence of Terminal Calibration Data, (3) Continuous Time vs Halted Vehicle Gradiometer Operation, (4) Gradiometer Errors, (5) Zero Velocity and Gradiometer Calibration Stops, and (6) Gyro and accel-

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20. continued

erometer Errors.
This report concluded that (1) the gyro and accelerometer errors limit ability to derive deflections from frequent zero velocity updates (at vehicle stops); gradiometer vs improved inertial system components are trade-off possibilities, (2) post-mission deflection recovery to 0.5 sec appears feasible with current IPS hardware augmented by high quality deflection values at both traverse end points and a moving-base gradiometer with field performance comparable to that recently demonstrated by laboratory prototypes (RMS noise < 10 EU, 10 second average, (3) Real-time deflection recovery to 0.5 sec is ultimately possible in an environment of moving-base gradiometer availability, highly accurate end point deflection data and moderately improved RGSS inertial components, (4) the dominant factor limiting RGSS deflection recovery both with and without gradiometer aiding is the quality of vettical deflection data which is independently available at traverse end points.

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1. REPORT NUMBER **ETL-0114**	2. GOVT ACCESSION NO. AD-B024 504L	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AUTOMATED PROCESSING OF GEOGRAPHIC INFORMATION IN IMAGE DATA FORMS		5. TYPE OF REPORT & PERIOD COVERED Technical Report 1976-1970
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Bernard B. Scheps		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE August 1977
		13. NUMBER OF PAGES 145
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Image Data Processing
Image Data Forms (IDF)
Slope maps

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Present day technology is rapidly developing that will improve the way in which image data are processed for geographic information and for military applications. This report states current capabilities and supports technical capabilities that can be had by 1985 or beyond. This report discusses system concepts, technical possibilities, and problems that must be addressed.

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1. REPORT NUMBER **ETL-0115**	2. GOVT ACCESSION NO. AD-A051 483	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* PARALLEL PROFILE PLOTS FOR VISUAL TERRAIN DISPLAY		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Cyrus C. Taylor		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS R4303-01-16
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE September 1977 13. NUMBER OF PAGES 38
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16. DISTRIBUTION STATEMENT *(of this Report)*

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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Three Dimensicnal Display
Terrain Plots
Parallel Profile Plots
Oblique Terrain Projections
3-D Maps

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The production of parallel profile plots of terrain elevation data grids in the oblique projection is studied, algorithms developed and software written. The additional problem of deleting profile lines in areas of low information content is addressed and partial solutions presented.

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4. TITLE (and Subtitle) MODIFICATIONS TO FOTONAP		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Georg E. Morduch		8. CONTRACT OR GRANT NUMBER(s) DAAK70-77-F-0130
9. PERFORMING ORGANIZATION NAME AND ADDRESS Old Dominion Systems, Inc. 4 Professional Drive, Suite 119 Gaithersburg, Maryland 20760		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE July 1977 13. NUMBER OF PAGES 34
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

UNIVAC 1108
CDC 6400
Fotonap Program
Geoceiver Measurements
Hopfield Formula
Tropospheric Refraction
Zenith Integral

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Fotonap program has been modified (i) to include the option to compute the desired solution without inverting the normal equations matrix (thus not obtaining the solution covariance matrix), and (ii) to include the capability to handle Geoceiver measurements. For a typical run involving photogrammetric data, implementation of item (i) reduced the time taken to obtain the normal equations solution from 1 hour 50 minutes to 20 minutes. Two types of Geoceiver measurements have been modeled in Fortnap: satellite-to-ground and

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20. continued

satellite-to-satellite. Each Geoceiver type may use either a fixed or a variable averaging time. Included in the implementation of the Geoceiver measurements is the Hopfield model for computing trpospheric refraction corrections.

The above modifications have been implemented both on the UNIVAC 1108 and the CDC 6400 versions of Fotonap.

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: ETL-0119	2. GOVT ACCESSION NO.: AD-A050 034
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): HIGH SPEED PARALLEL SENSING SCHEME	5. TYPE OF REPORT & PERIOD COVERED: Research Note
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Pi-Fuay Chen William W. Seemuller	8. CONTRACT OR GRANT NUMBER(s):
9. PERFORMING ORGANIZATION NAME AND ADDRESS: U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 6.11.02.A, 4A161102B52C,02
11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060	12. REPORT DATE: December 1977
	13. NUMBER OF PAGES: 33
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
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16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Solid State Sensor Arrays
Two-Dimensional Translational Stages
High Speed Parallel Scanning
Pixel
Imagery

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A high speed parallel scanning scheme is described that uses high density linear sensor arrays to convert optical images into electrical signals for computer processing or storage.

By using two 1,024-element linear arrays in a staggered line and x-y translational stages, a 9- by 9-inch transparency can be scanned and digitized into 8.5×10^7 pixels in 1 minute. Scan time can be reduced by increasing the slew rate of the stage or by increasing the scan line by using additional

continued

20. continued

arrays. Since each array produces four simultaneous video signals, the system could be utilized as an input device for a parallel processor such as the STARAN. The video signals can be multiplexed onto a single line if desired.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0120	2. GOVT ACCESSION NO. AD-A048 666	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Electron Beam Recorder Applications Study		5. TYPE OF REPORT & PERIOD COVERED Contractor Report April 1977 - August 1977
		6. PERFORMING ORG. REPORT NUMBER FF-12
7. AUTHOR(s) James J. Greed, Jr. Gerald N. Wallmark		8. CONTRACT OR GRANT NUMBER(s) DAAK70-77-C-0111
9. PERFORMING ORGANIZATION NAME AND ADDRESS Carson Alexiou Corporation 345 Wilson Avenue Norwalk, Connecticut 06854		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE August 1977
		13. NUMBER OF PAGES 111
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Electron Beam Recording, Automated Cartography, Pressplates, Projection Platemaking, Laser Platemaking, Mass Data Storage		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Electron Beam Recording (EBR) was studied in the context of its potential uses in the Defense Mapping Agency. It was found to have applications in cartographic recording, textual recording, and microfiche preparation. The making of pressplates from EBR masters involves the use of optical projection systems and "projection speed" materials. The properties of several such materials were found to be suitable. continued		

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Non-cartographic users were also found, including the potential for exploitation of the very high resolution available from an EBR for mass memory applications.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER **ETL - 0121**	2. GOVT ACCESSION NO. AD-A048 078	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* DEVELOPMENT OF A HIGH PRECISION CAPABILITY FOR MONITORING STRUCTURAL MOVEMENTS OF LOCKS AND DAMS		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Kenneth D. Robertson		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 16R67RI0001
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE September 1977 13. NUMBER OF PAGES 70
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT *(of this Report)* Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)* Dam Safety Precise Survey Trilateration Dam Deformation		
20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)* A program of periodic inspection and continuing evaluation is required to insure the safety of many civil works structures. This report documents a Corps of Engineers program to develop a capability within the various Engineer districts for making very high precision survey measurements of structures. The program consisted of measurements of several structures and of training programs for survey personnel. Results of the measurements are included.		

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0122	2. GOVT ACCESSION NO. AD-A045 618	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* OPTIMIZED METHOD FOR THE DERIVATION OF THE DEFLECTION OF THE VERTICAL FROM RGSS DATA		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) John Lyon G. L. Mader F. T. Heuring		8. CONTRACT OR GRANT NUMBER(s) DAAK70-77-C-0126
9. PERFORMING ORGANIZATION NAME AND ADDRESS Phoenix Corporation 1311 Dolley Madison Blvd. McLean, Virginia 22101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE October 1977 13. NUMBER OF PAGES 38
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

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17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Rapid Gravity Survey System (RGSS)
Inertial Positioning System (IPS)
Gyro Drift Biases
Anomaly Covariance
FORTRAN Source Listing

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The Rapid Gravity Survey System (RGSS) provides a means of quickly measuring precisely non-astrogeodetic values of the deflections of the vertical. A test vehicle carries an Inertial Positioning System (IPS) which at each of the vehicle's stops produces an error velocity which can be related to the inertial platform tilt errors and the deflections fo the vertical. An optimal determination of the gyro drifts and the deflections of the vertical can only be obtained by a post-mission smoothing of the data. In this case, accurate data are available a priori for the deflections of the vertical at the start and stop of the vehicle's

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20. continued

mission -- as well as the data on the IPS velocity errors at each stop.

The purpose of this report is to develop the equations for the position, velocity, and tilt angle errors into a useable algorithm for the optimal estimation of the deflections of the vertical. As a result, three major analytic tasks are presented. This mathematical development enables the production of a machine algorithm for use with actual data. The final section of the report contains a coded version of the algorithm with explanatory comments.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL- 0123	2. GOVT ACCESSION NO. AD-A047 825	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* HOLOGRAPHIC OPTICAL ELEMENTS WITH LOW Q-FACTORS		5. TYPE OF REPORT & PERIOD COVERED Research Note 1975-1976
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) William R. Graver		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Va. 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52C-05-0001
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Va. 22060		12. REPORT DATE October 1977
		13. NUMBER OF PAGES 44
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Optics
Lasers
Holography

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Holographic optical elements, with low Q-factors, are theoretically modeled and experimentally constructed. An optical performance evaluation yields (1) a low reconstruction angle sensitivity of 14 degrees, (2) a high diffraction efficiency of 50 percent, and (3) an optical path deviation of $\lambda/4$.

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1. REPORT NUMBER ETL-0124	2. GOVT ACCESSION NO. AD-A047 668	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and subtitle) BACKSCATTERING OF RADAR WAVES FROM A TILTED, SLIGHTLY ROUGH SURFACE		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER NA
7. AUTHOR(s) Richard A. Hevenor		8. CONTRACT OR GRANT NUMBER(s) NA
9. PERFORMING ORGANIZATION NAME AND ADDRESS Data Processing and Products Division U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52C
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE June 1977 13. NUMBER OF PAGES 34
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE NA

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Radar Scattering
Electromagnetic Waves
Random Rough Surfaces

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents the derivation of an equation for the radar backscatter coefficient from a tilted, slightly rough surface. The basic technique employed in the solution is the small perturbation method, along with the Fourier transform. The incident wave is allowed to have an arbitrary polarization, and specific results are shown for horizontal, vertical, circular, and elliptical polarizations. One conclusion of this report is that the influence of a given slope of the tilted rough surface, upon the calculation of the radar backscatter coefficient, depends upon the polarization of the incident electromagnetic wave.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0125	2. GOVT ACCESSION NO. AD-A047 824	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* SCATTERING OF A CODE-MODULATED RADIO SIGNAL AND ASSOCIATED MULTIPATH RANGE ERRORS		5. TYPE OF REPORT & PERIOD COVERED Research Note 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Dr. Eugene A. Margerum Dr. Frederick W. Rohde		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Research Institute Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 6.11.02.A, 4A161102B52C, S3, 1752CS30003
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE January 1977 13. NUMBER OF PAGES 35
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Multipath	Gold Code
Scattering	Code Modulation
Radar	Carrier Cancellation
Positioning	Ranging

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

To account for range errors obtained when a code-modulated radio signal is used to make range measurements in a scattering environment, a mechanism termed "carrier cancellation" is proposed. This allows for destructive interference between several nearly direct path signals, leaving the possibility for a weaker signal that has traveled over a longer path to predominate. A mathematical formulation of the phenomenon is given, and the equations derived are used for a computer simulation of the effects. The results of the simulation confirm that the proposed mechanism represents a viable explanation of the observed range errors.

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1. REPORT NUMBER ETL-0126	2. GOVT ACCESSION NO. AD-A049 351	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Selected Bibliography of Corps of Engineers Remote Sensing Reports		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Theodore C. Vogel E. James Books		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A762707A855
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, VA 22060		12. REPORT DATE August 1977 13. NUMBER OF PAGES
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Aerial Imagery	Photo Interpretation
Cartography	Remote Sensing
Coastal Engineering	Terrain Analysis
Cold Regions	Thematic Mapping
Multispectral Imagery	Trafficability

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this bibliography is to present a selected list of remote sensing technology reports and papers published by the U.S. Army Corps of Engineer Divisions, Districts, and Research Laboratories. This bibliogrpahy documents the importance of remote sensing technology to the Corps of Engineers and the many and varied tasks to which it has been applied.

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1. REPORT NUMBER ETL-0129	2. GOVT ACCESSION NO. AD-A047 981	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Environmental Conditions in a Tropical Forest Region in Thailand		5. TYPE OF REPORT & PERIOD COVERED Contract Report 6. PERFORMING ORG. REPORT NUMBER 109
7. AUTHOR(s) Helmut E. Landsberg Owen E. Thompson Robert E. Kaylor Rachel T. Pinker		8. CONTRACT OR GRANT NUMBER(s) DAAK 02-72-C-0287
9. PERFORMING ORGANIZATION NAME AND ADDRESS Institute for Fluid Dynamics & Applied Mathematics University of Maryland College Park, Maryland 20742		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE November 1974 13. NUMBER OF PAGES 171
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Climatological	Relative Humidity
Infra-red Radiation	Richardson Gradient Number
Micrometeorological	Solar Radiation
Monsoon	Thailand
Rainfall	Tropical Forest

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Major results of a two year project to study the climatological and micrometeorological conditions in a tropical evergreen forest region and summarized in this report. The study has been under the sponsorship of the U. S. Army Engineer Topographic Laboratory. The forest area under study is in the interior of Thailand and is influenced by a cool, dry northeast monsoonal flow from November to March and a warm, moist southwest monsoonal flow from May to September. Measured information were collected during a three

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20. continued

year field program sponsored by the U.S. Army Natick Laboratories and included ground station temperature, relative humidity, precipitation, evaporation, hours of sunshine, and tower measurements of temperature, dew point temperature, and wind speed, incoming and reflected solar radiation, incoming and outgoing infra-red radiation and sub-surface temperature profiles in the forest and in a cleared area within the forest region.

The results discussed here include a climatological survey of the experimental iste as well as a comparison of the monsoonal cycles at a number of widely dispersed sites in Southeast Asia; an analysis of the profiles of temperature and wind speed in the forest and cleared area; diurnal variations of static stability and Richardson number representative of several different periods of the year; a summary of calculations of the roughness characteristics of the forest canopy and the variability thereof; spectral analyses of kinetic energy above and within the forest canopy during both monsoonal flow regimes; estimates of the albedo of the for st and the net fluxes of radiational energy for several periods of the year; estimates of sensible and latent heat fluxes above the forest canopy.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0130	2. GOVT ACCESSION NO. AD-A050 024	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) CHEMICAL ARRAY STUDIES		5. TYPE OF REPORT & PERIOD COVERED Research Note
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Pi-Fuay Chen James W. Gladden		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Research Institute U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 4A161102B52C Task 02 Work Unit 0002
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer Topographic Laboratories Fort Belvoir, Virginia 22060		12. REPORT DATE December 1977 13. NUMBER OF PAGES 20
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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18. SUPPLEMENTARY NOTES

Continuous Photoconductive Layer Array
Cadmium Sulfide
Zinc Oxide
Sensor Arrays

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The feasibility of developing continuous photoconductive layer arrays for mapping applications was studied. The procedures for preparing both the zinc oxide binder resin, and the undoped sintered cadmium sulfide, continuous photoconductive layers are presented. Special configuration area arrays with large multi-electrodes for beam centering purposes and for diffraction pattern detectors were devised. The mapping applications of the chemical arrays such as position detection, area, and center of mass

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20. continued

measurements of uniformly dense-image patterns are described. Both zinc oxide and cadmium sulfide photoconductive layers were used to fabricate one- and two-dimensional arrays. Successful results were obtained for a one-dimensional 10-wire electrode, linear array. The fabrication of area chemical arrays were not successful. To fabricate a workable special configuration area array, more sophisticated methods such as sputtering and vacuum deposition techniques are necessary. A negligible error was obtained for the analysis of chemical arrays as position detection and area measurement. A larger error resulted for the center of mass measurement.

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: ETL-0131	2. GOVT ACCESSION NO.: AD-A052 143
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Formulation of a Space Oblique Mercator Map Projection	5. TYPE OF REPORT & PERIOD COVERED: Contract Report
6. PERFORMING ORG. REPORT NUMBER: UVA/525023/MAE77/105	
7. AUTHOR(s): John L. Junkins, James D. Turner	8. CONTRACT OR GRANT NUMBER(s): DAAG53-76-C-0067
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Research Laboratories for the Engineering Sciences, University of Virginia, Charlottesville, Virginia 22901	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE: November 1977
	13. NUMBER OF PAGES
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

remote sensing, LANDSAT, ERTS, conformal, map projection, Mercator.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report develops a *dynamic* map projection especially suited of processing and displaying of satellite electro-optical remote sensing of the earth's surface. The new map projection (the Space Oblique Mercator) projects the satellite ground-track from the ellipsoid into the map plane, free of length distortion and free of *normal view curvature* distortion. The length and curvature distortions in the finite sensed region are negligible for most applications. The report details the formulation, provides numerical examples for the LANDSAT-1 multi-spectral scanner, and includes FORTRAN IV software as an appendix.

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ETL-0133	2. GOVT ACCESSION NO. AD-A049 308	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Precision Staran Correlator		5. TYPE OF REPORT & PERIOD COVERED Final Report October, 1976 to June, 1977
		6. PERFORMING ORG. REPORT NUMBER GER-16464
7. AUTHOR(s) T. E. Gorsica L. D. Stoner		8. CONTRACT OR GRANT NUMBER(s) DAAK 70-76-C-0247
9. PERFORMING ORGANIZATION NAME AND ADDRESS Goodyear Aerospace Corporation Akron, Ohio, 44315		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineering Topographic Laboratory (CSL) Meradcom Fort Belvoir, Virginia, 22060		12. REPORT DATE 1 June 1977 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Correlation of digital images; Pershing II terminal guidance system simulation.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report describes a digital image area correlation computer program written for the U. S. Army Engineering Topographic Laboratories CDC-6400 and Staran computers. Its purpose is to predict the strength and positional registration of the correlation of two input images: (1) a live image taken from flight tests of the U. S. Army Pershing II missile terminal guidance system; (2) a reference image for use with the above guidance system		

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Flux Valve
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Magnetic Field
True North

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes a Flux Valve Heading Reference System(FVHRS) designed by Sperry. The flux valve is an electromagnetic device designed to measure the amplitude and direction of the earth's magnetic field. It provides a rapid means of aligning a gyrocompass to an approximate north direction, thus greatly reducing the time necessary to determine true north gyroscopically. The report describes the flux valve theory, trade-offs, and the FVHRS hardware.

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Energy Survey, Environmental Survey, Remote Sensing, Aerial Photography, Thermal Infrared Imagery

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The results of this survey demonstrate the feasibility of using multispectral remote sensing techniques, whereby an U. S. Army Facility Engineer can reduce the number of man-hours currently required for energy and environmental assessments. These include detecting building heat losses and deteriorated insulation invisible to the human eye, performing electrical inspections under full operating loads, and monitoring environmental conditions on a successive annual basis. This survey method, developed during the winter and

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20. continued

summer of 1976, employs a handheld infrared imaging device, color and color infrared aerial photography, and thermal infrared imagery.

The thermal infrared imagery is used in conjunction with color aerial photography to detect energy losses and defective roof insulation. This imagery should be obtained during the winter season on a 2-year cycle, 2 to 3 hours after sundown at a scale of 1:4,000.

The color and color infrared photography aids the Facility Engineer in the analysis of the thermal infrared imagery, provides a source of information for establishing a baseline of environmental conditions for future comparison, and monitors potential environmental problem areas. This photography should be obtained simultaneously on a 4-year cycle, between the hours of 1000 and 1500 at scales of 1:10,000 and 1:20,000. During the first cycle, the photography should be obtained in conjunction with the winter thermal infrared flights and repeated during the summer season. The photography and infrared imagery should always be acquired under clear, unobstructed skies.

The handheld infrared device is employed to determine the exact locations of energy losses and roof areas underlain with wet insulation after they have been detected on the aerial infrared imagery. The device can also be used to survey electrical distribution systems, detect heat losses through building walls, and monitor steam lines.

This report is illustrated, has a bibliography, and a plan of approach.

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INDEXES

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